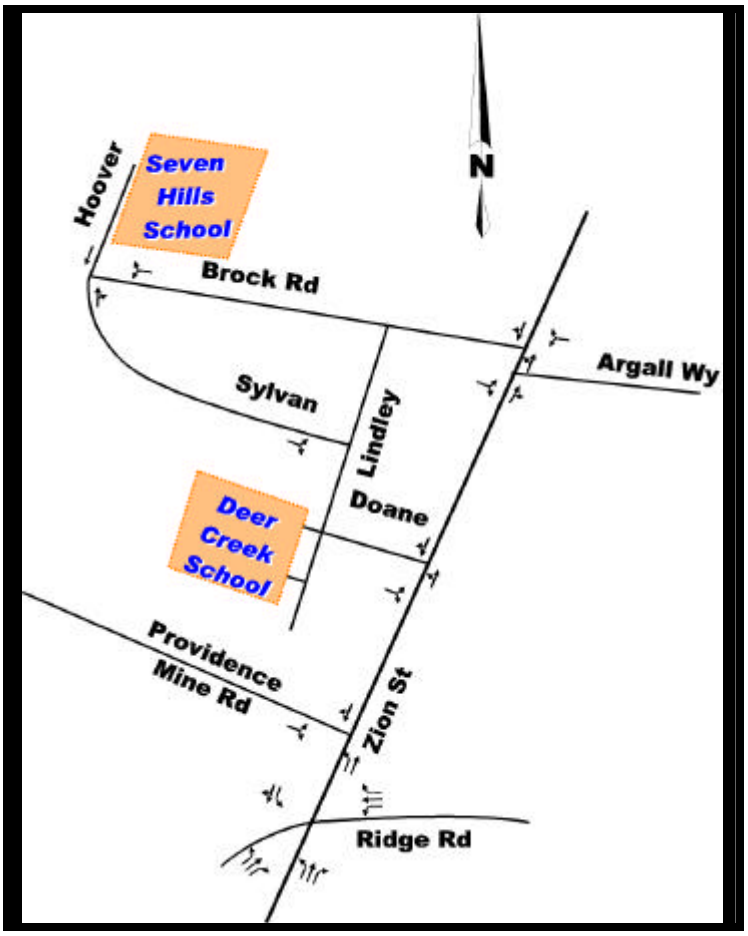
FINAL REPORT



SEVEN HILLS SCHOOL STUDY

Prepared for
THE NEVADA COUNTY TRANSPORTATION COMMISSION

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Executive Summary

The existing street network system servicing the Seven Hills and Deer Creek schools, etc., is not currently optimized to handle the peak traffic flows typical of school traffic (20-30 minute peak). In addition to the traffic impacts from the Deer Creek and Seven Hills school traffic, there are the additional traffic impacts from the Nevada Union High School to the Ridge Road / Zion Street intersection. It is the conclusion of this report that a two-fold mitigation to the study area street network is necessary to fully mitigate the impacts of school traffic. The necessary mitigations to the street network are as follows:

Mitigation 1: Improve Traffic Circulation in Immediate Vicinity of Schools

Even though there are regulatory signs installed by the City to help guide motorists to use certain streets (such as Doane Avenue), and avoid others (such as Brock Road), there are capacity constraints that require mitigation to help make the use of Doane Avenue possible. These are as follows:

- Install a left turn pocket on Zion Street at Doane Avenue to facilitate the inbound movement of school-related traffic. This will help facilitate through traffic movement, which is significantly impeded by school traffic waiting to turn left onto Doane Avenue.
- Remove parking on east side of Zion Street in the vicinity of Doane Ave. to accommodate the left turn pocket and through lane northbound.
- Install a three-way stop sign control at the intersection of Zion Street and Doane Avenue

The three way stop sign control at the intersection of Zion and Doane, and the proposed left turn pocket will help facilitate a left turn out from Doane Avenue, which is prohibited during school arrival and departure peaks. By providing a left turn out from Doane Avenue the impact of traffic to the Zion Street / Ridge Road intersection is lessened. Reference is made to Figure E-1 for an illustration of what currently exists, and what is being proposed in this mitigation.

The existing condition is shown on the left side of the figure (not to scale), and the proposed mitigation for the same area of Zion Street is shown on the right side of the figure (also not to scale). Cars in parking areas are shown in red, and all moving vehicles in the traveled way are depicted in white.

Mitigation 2: Improve Traffic Flow and Capacity of Ridge / Zion Intersection

A modern roundabout installation at this location will significantly improve traffic flows of this skewed intersection. The roundabout will help lessen the impact of the skewed intersection approaches, and will help eliminate the current driver confusion and indecision which exists today. The installation of a circular roundabout (recommended) will require the acquisition of some additional right-of-way on the northwest and southeast quadrants of the intersection. Reference is made to Figure E-2 for an illustration (drawn to scale) of the proposed modern roundabout installation for this location.

The installation of the roundabout shown in Figure E-2 will significantly increase the capacity of the intersection, and will eliminate the need for a traffic signal both for existing conditions and in the future as well (signal warrants are met for minimum vehicular volume).

A large 150 foot diameter circle is being proposed, which can easily accommodate the largest of trucks and all buses that would enter the intersection. A dual lane approach is proposed for the Zion Street approach to facilitate the larger volumes of vehicles that will enter the roundabout from this approach. This dual lane approach will tend to favor traffic entering the circle from this direction (which will help alleviate the long lines of congestion that are now occurring on Zion Street for the southbound direction during peak hours).

All approaches for the roundabout are yield on entry, meaning that all vehicles already in the circle have the right-of-way. The westbound approach of Ridge Road has a free-right turn lane to divert all Zion Street bound traffic away from interfering with roundabout traffic and capacity. The eastbound approach also has such a lane. For an illustration of the existing condition of this intersection (four-way stop), see the Analysis section of this report.

In addition to this roundabout installation, it would also be needed to remove the existing stop sign for the eastbound approach of the Ridge Road / Searls Road intersection. This would eliminate the long queue of vehicles which often backs up from Searls to Zion Street during school peak hour time periods.

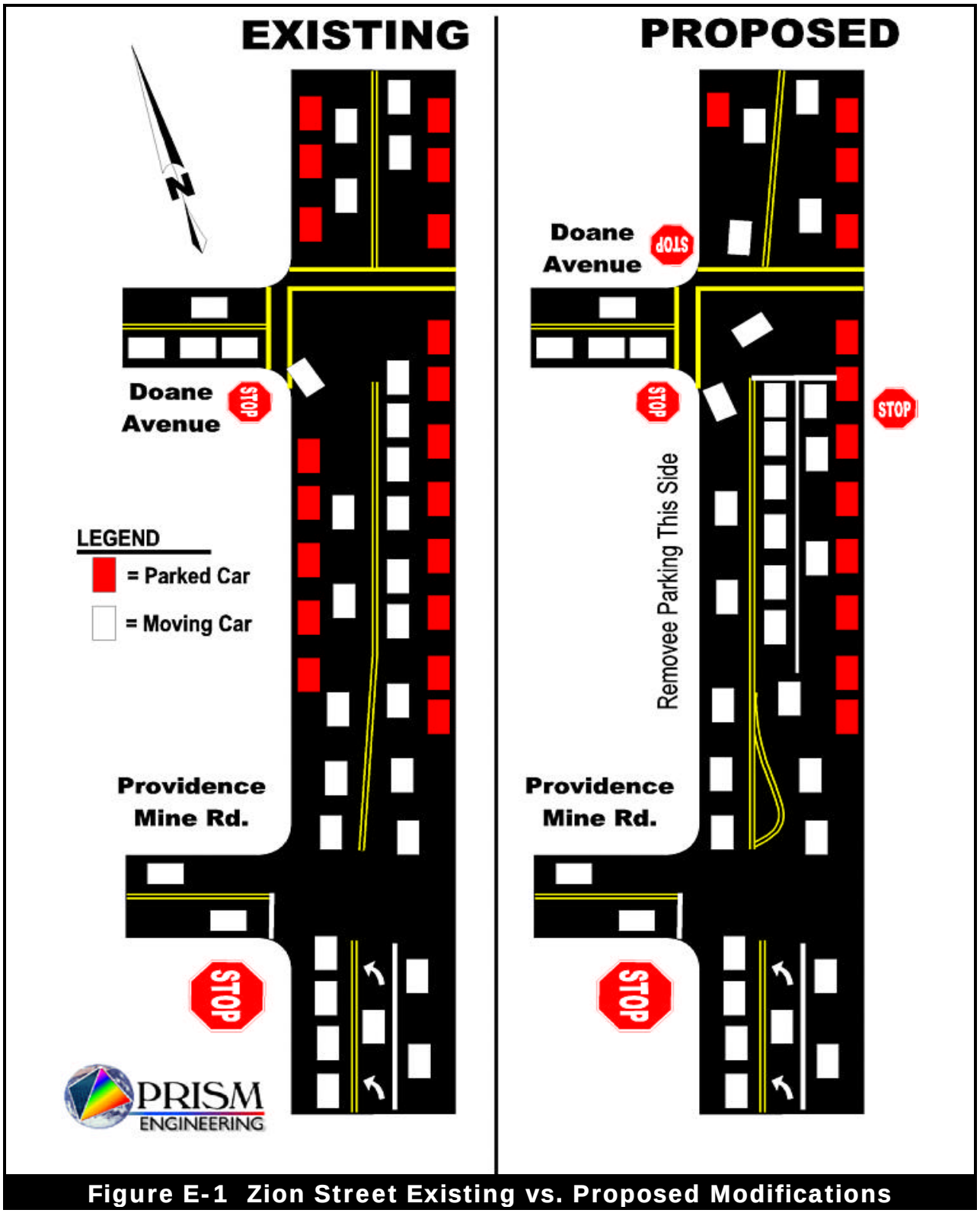

Figure E-1 Zion Street Existing vs. Proposed Modifications

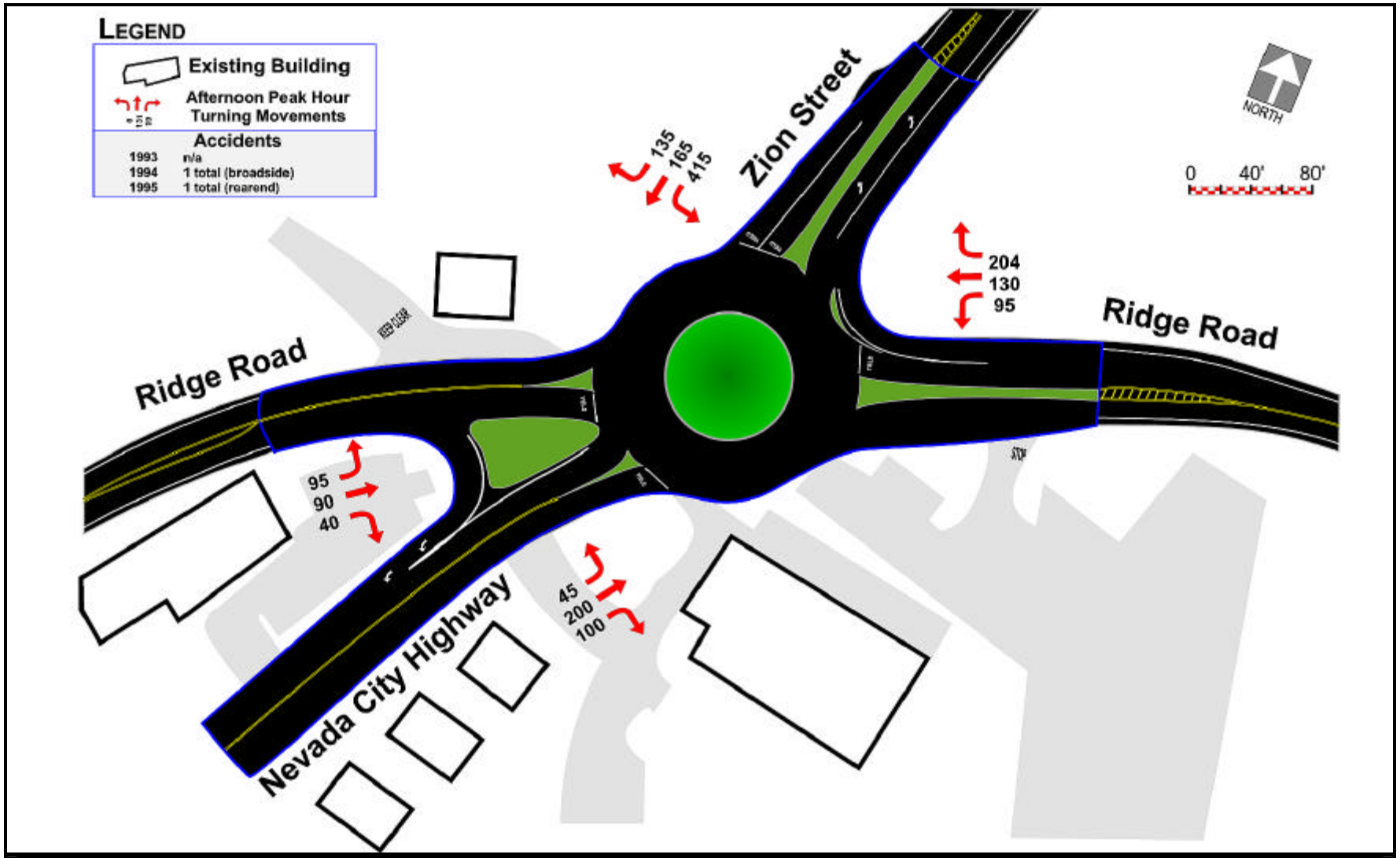

Figure E-2 Ridge Road / Zion Street Proposed Modern Roundabout

Introduction and Overview

The Zion Street corridor from Ridge Road to Doane Avenue is now experiencing significant school related traffic impacts, taking place twice a day. In addition, several streets connecting to the Zion Street corridor are not optimized to handle these peak traffic flows. In this study, additional roadways or connections are investigated as potential solutions (such as a connection to Providence Mine Road through the Tektronix property). As a result, there would be traffic circulation changes and the effects of these changes need to be analyzed (such as any significant increases to Providence Mine Road, etc.)

The Seven Hills campus is planning to add additional buildings including an art complex, but no increase in traffic is anticipated. Additional parking is being constructed to accommodate the district office. Additional child-care facilities are being constructed, which will increase traffic, but traffic from this will use Hoover Lane and not conflict with the current home to school schedules, and does not coincide with the peak hour time periods studied in this report (7:30 am to 9:00 am, and 2:30 pm to 4:00 pm).

The peak school traffic seems to already be affecting other non-school drivers choices, by stretching out the peak “hour” as drivers delay or change their trip times to avoid school traffic.

The location of the schools in reference to the local street system is given in Figure 1, which is a vicinity map of the study area.

Figure 2 is also a more localized vicinity map of the immediate school area, and shows the existing traffic control for each intersection, as well as the number of approach lanes and their specific configuration. Also shown on Figure 2 are three photos of various regulatory signs currently in use by the City of Nevada City to help control school traffic flow. A portable sign is employed on Doane Avenue to prohibit left turns onto Zion Street during peak school traffic in an effort to eliminate some of the conflict and delay. The other regulatory signs are permanent installations, but merely serve as a guide and are difficult to enforce. The location of these signs is given with a blue arrow on the figure.

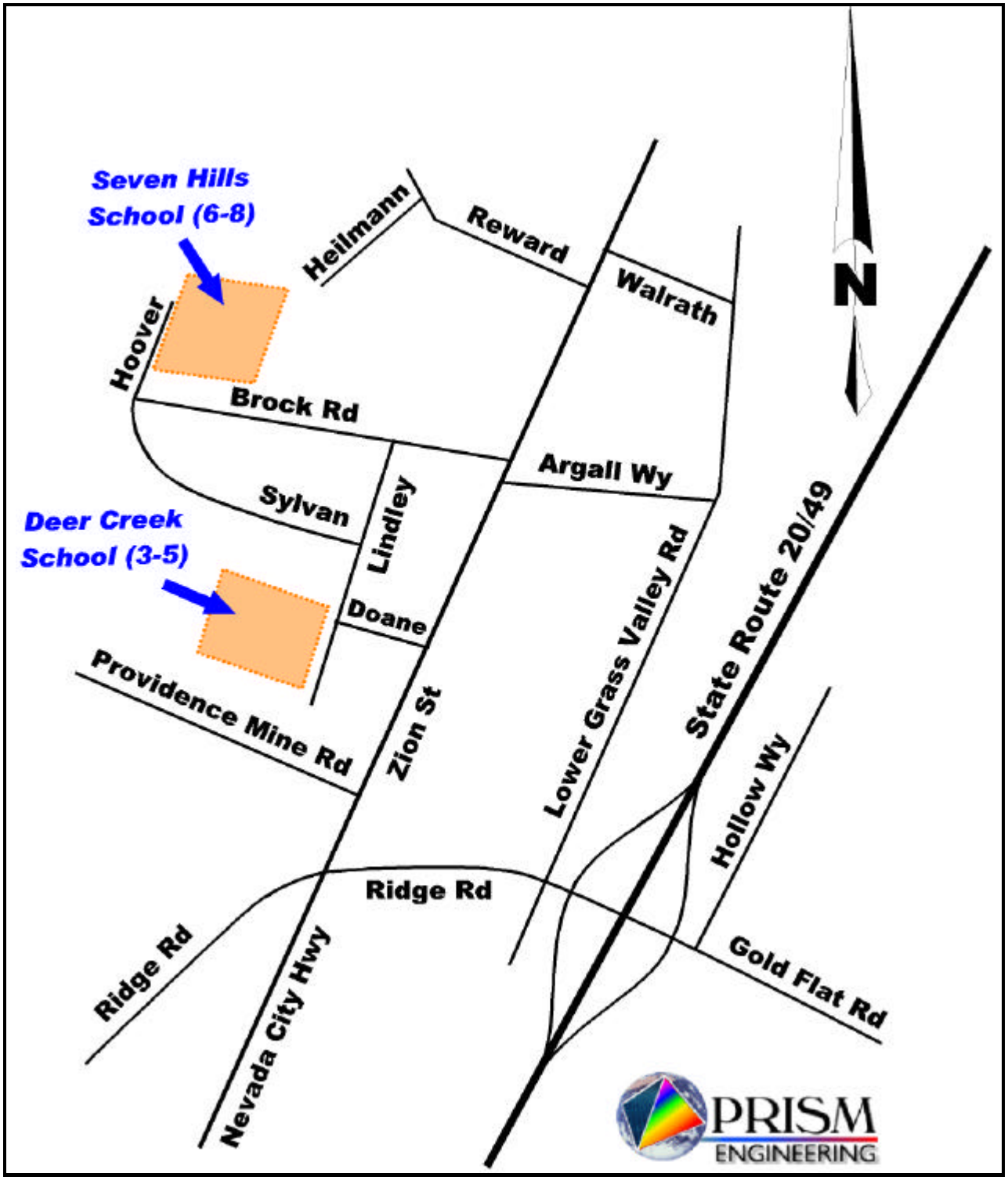

Figure 1 Vicinity Map of Seven Hills and Deer Creek Schools

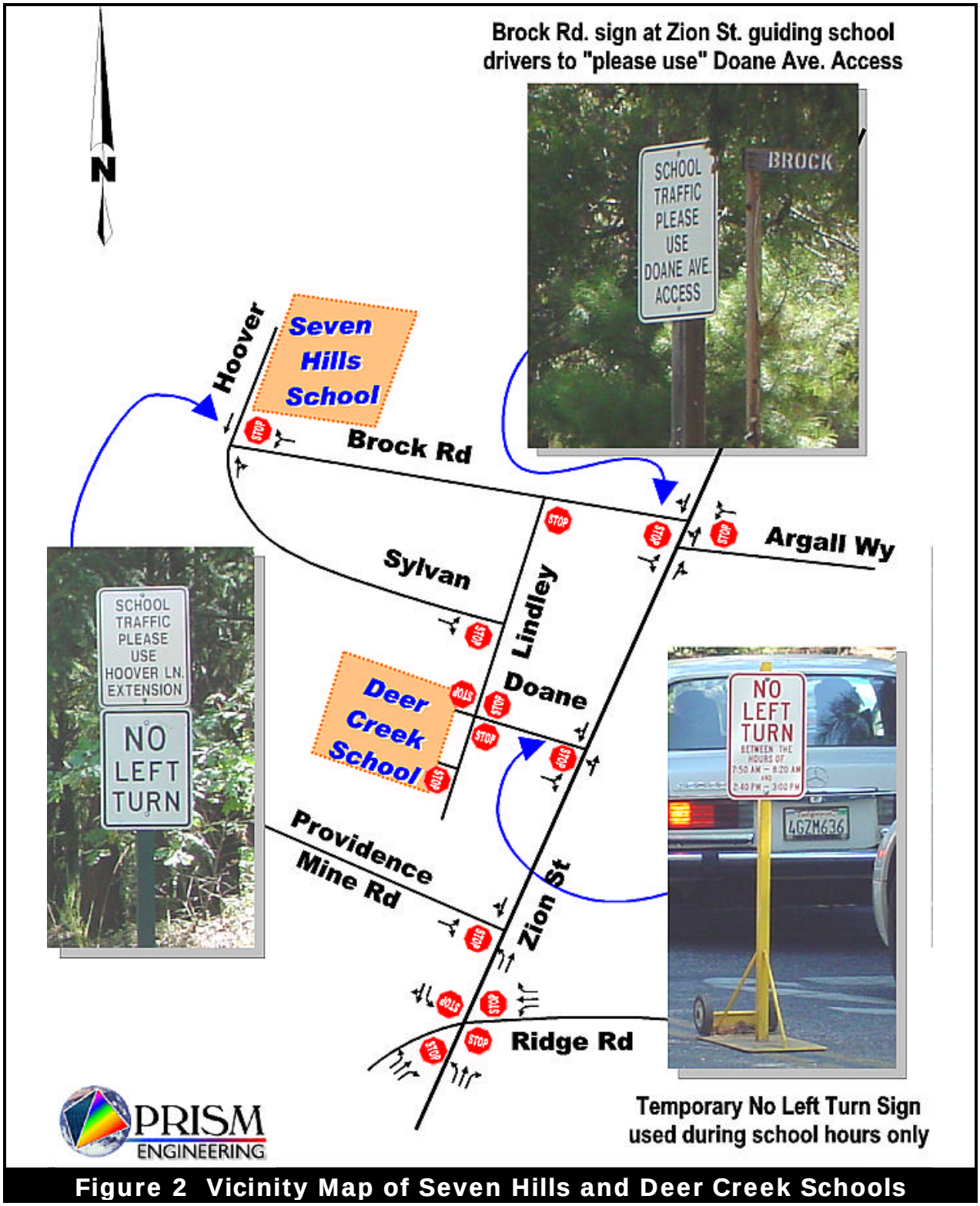

Figure 2 Vicinity Map of Seven Hills and Deer Creek Schools

Study Methodology

New traffic counts were taken along the Zion Street corridor from Ridge Road to Brock Road during the a.m. peak hour of the school (7:30 a.m. to 9:00 a.m.), as well as the afternoon peak hour of the schools (2:30 p.m. to 4:00 p.m.) This count data is summarized in Figures 3 and 4 for the am school peak hour and the afternoon school peak hour respectively. This new data was used to analyze levels of service for the following four study intersections:

- Zion Street and Ridge Road
- Zion Street and Providence Mine Road
- Zion and Doane
- Zion Street and Brock Road

The Synchro pro software was used to conduct the capacity analyses for this study, and also to simulate traffic flows along the corridor. This software also allows visual inspection of link segment traffic operations, including buses.

The level of service for each intersection during the morning to a.m. peak hour and afternoon peak hour time periods is summarized, and an alternative is included where increased busing is considered, along with the traffic impact reductions that this would be anticipated to produce. Traffic circulation changes are also investigated in this study, and how proposed changes would affect street system design, etc. Lastly, traffic demand management (TDM) is considered to investigate the effect of staggering school shift schedules will have on traffic flows and delay, etc.

Study Area Roadways

Zion Street: A two lane arterial facility in the vicinity of the project with parking on both sides of the street north of Providence Mine Road, and continuing until past Brock Road.

Ridge Road: A two lane arterial facility that connects SR 20/49 to Zion Street, and continues past the study area. This facility also carries heavy traffic loads to and from the Nevada City Union High School located southwest of Zion Street.

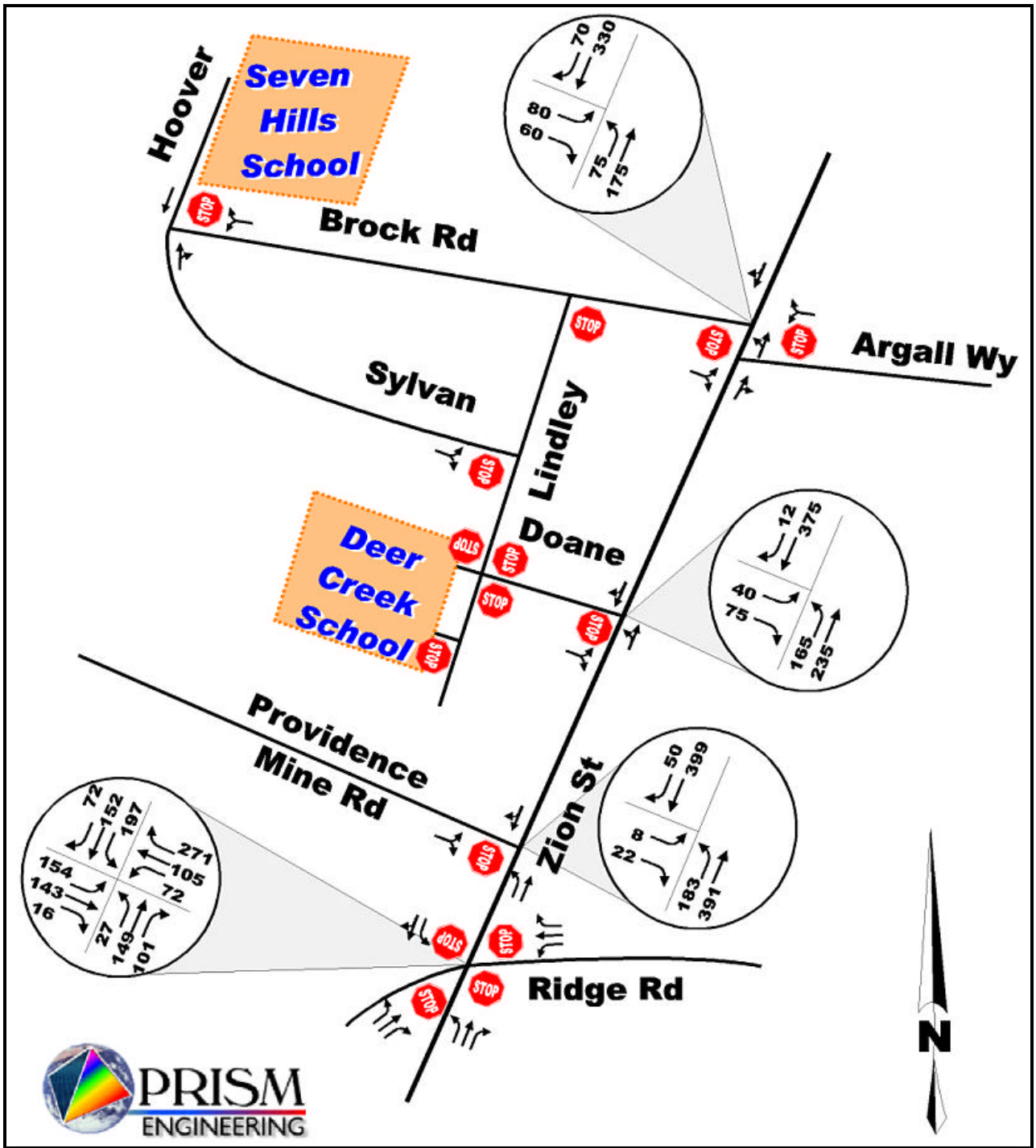

Figure 3 School Peak Hour Turning Movements (7:30-8:30 am)

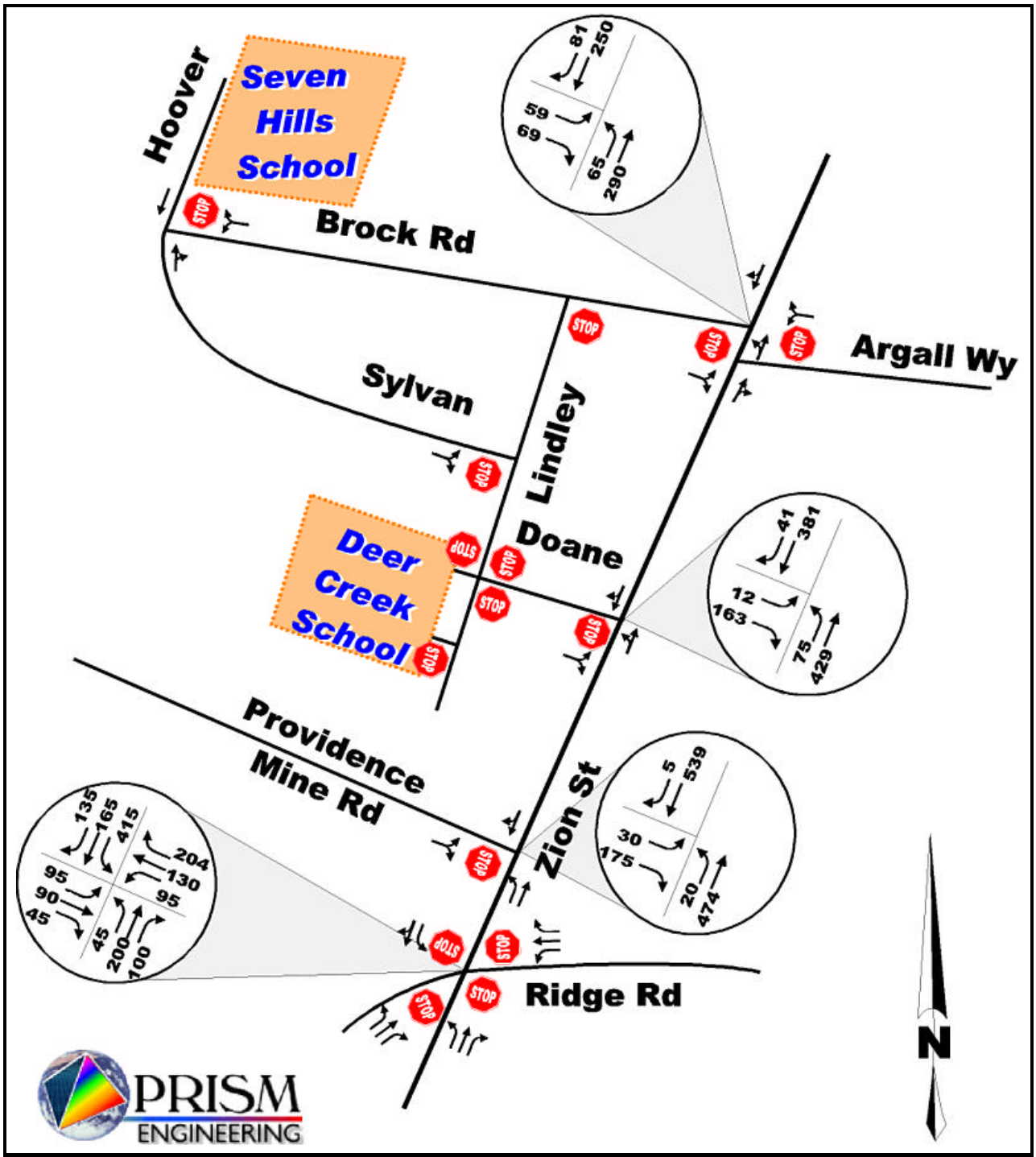

Figure 4 School Peak Hour Turning Movements (2:30-3:30 pm)

Providence Mine Road: A two lane collector roadway connecting to Zion Street just north of Ridge Road. This road services several office / industrial uses in the study area, including the Textronix site. There is no parking on either side of this road in the study area.

Doane Avenue: A two lane local street without any parking on either side. It primarily connects Lindley (the street to which Deer Creek School gains access) to Zion Street. It is the primary designated school access street for both Deer Creek and Seven Hills Schools.

Brock Avenue: A narrow two lane local residential street near Zion Street, but which widens to allow parking as it approaches Hoover Lane. School traffic is encouraged (through regulatory signs) not to use this street. However, enforcement is difficult.

Figures 5A and 5B are photo summaries of traffic conditions and traffic control relevant to this study. It can be seen that long lines of traffic form, where congestion exists, and what kind of traffic control is currently in place.

Lindley Avenue: A two lane local residential street running parallel to Zion Street. This street fronts along the Deer Creek middle school, and has two driveways from that school that access Lindley. Lindley Avenue intersects Doane Avenue on the south, and Hoover/Sylvan on the north.

Hoover Lane: A two lane local residential street that provides access to the Seven Hills School on its north end, and intersects with Brock Avenue in the vicinity of the school campus. This street primarily serves school related traffic. Traveling south on Hoover Lane south of Brock Avenue, this road transitions into Sylvan. Much of this roadway is fronted by trees, and has very little access between Sylvan and Brock.

Sylvan Avenue: A two lane local residential street connecting Hoover Lane on the west with Lindley Avenue on its east end. This street primarily serves school related traffic, and carries bus traffic from the Seven Hill School.

Looking west onto Doane Avenue from Zion Street. Traffic is bumper to bumper in both directions. No left turn is allowed out of Doane Street onto Zion, forcing all traffic to impact the Ridge / Zion intersection.

Buses loaded with Seven Hills students on the way home (approx. 3:00 pm), turning left onto Doane Avenue from Lindley, headed towards Zion Street to turn right and travel towards Ridge Road.

Even though traffic is prohibited from turning left from Hoover to Brock, a significant amount of traffic is finding its way to the Brock / Zion intersection during school peak hours, possibly from Deer Creek school.

This regulatory sign on Brock Rd. asks school traffic to "please" use Doane Avenue. Even so the inbound traffic is slightly higher than Doane, and the outbound left turns are significantly higher than Doane.

Figure 5A Traffic Observations During Peak School Traffic Time Periods

A very long line of cars on Zion Street southbound from Doane Avenue to Ridge Road. Traffic blocks the Providence Mine Road outbound traffic. It also blocks inbound school traffic turning left onto Doane Avenue.

A line of cars on Zion Street northbound, as one car waits to turn left on to Doane Avenue, and blocks through traffic on northbound Zion Street. Through movements on Zion Street exceed this left turn move by a factor of 6, meaning for every left turn delayed, 6 vehicles desiring to go straight are also delayed.

Traffic headed north on Zion Street from Doane Avenue. About a fifth of this traffic is headed north to turn left onto Brock Road to get access to the schools during peak time periods.

This guide sign on Zion Street just north of Doane Avenue points the way to the preferred school access route. Despite the signage, it is apparent that drivers are taking the shortest time paths, and using Brock Road is an option that many drivers are exercising.

Figure 5B Traffic Observations During Peak School Traffic Time Periods

Existing Traffic Problem

Traffic conditions in the study area were extensive observed by a registered Traffic Engineer during both peak and off-peak time periods. During the peak time periods coinciding with school-related traffic (7:30 am to 8:30 am, and 2:30 pm to 3:30 pm), the following observations were made:

- The afternoon peak hour was slightly worse than the am peak hour, in terms of longer lines of vehicles on Zion Street (equating to more delays for drivers). The long lines formed on southbound Zion Street from Doane Avenue to Ridge Road for outbound school traffic mixed with regular Zion Street traffic.

- Traffic waiting to turn left onto Doane Avenue must wait for a gap in traffic, sometimes blocked by long lines of traffic headed southbound towards Ridge Road. The left turn movements are also blocking the traveled way for traffic headed northbound on Zion past Doane Avenue.

- The Ridge Road / Zion Street intersection operates inefficiently due to poor design, skewed approaches with multiple lanes and a four-way stop, etc. As a result, the heavy southbound Zion Street traffic entering the intersection forms long lines that extend back from Ridge to Doane Avenue and beyond (due to slow entrance into intersection). The traffic at this intersection is a mixture of regular area business traffic flows with the addition of school related traffic from Nevada Union High School, and Deer Creek School, and Seven Hills School. This traffic congestion for southbound Zion Street is exacerbated by the long lines of traffic waiting to move forward on Ridge Road, due to congestion backing from the Searls intersection.

- Providence Mine Road is largely underutilized, and has ample reserve capacity on the road segment itself, but traffic accessing Zion Street is still blocked due to the long lines on Zion Street which do not have to yield to Providence Mine Road traffic.

- Brock Road traffic is similar in volume to Doane Avenue (see Figures 3 and 4), indicating that the regulatory signs (shown on Figure 2) directing traffic to use Hoover Lane extension and Doane Avenue are not working very well.

- The traffic flows at Ridge Road and Searls Avenue are slowed due to the stop sign control for Ridge Road traffic east, which creates lines of traffic backing up towards the Zion Street intersection. It has been observed regularly where this line of traffic extends from Searls back to Zion Street, so that vehicles in the southbound left turn lane of Zion Street can not move forward until the Ridge Road traffic moves forward. This will be worsened as traffic flows increase in the future due to additional development of vacant lands. Zion Street will further break down in traffic operations as more people seek to go to Searls as a short-cut to get to the SR 20/49 freeway interchange. This additional cross-traffic at Searls will worsen the Ridge Road queue, and in turn, worsen the Zion Street / Ridge Road intersection congestion.

- Parking on both sides of Zion Street in the vicinity of Doane Avenue seems to contribute to the lack of capacity at this location.

Traffic Analysis

The traffic analysis involved inspecting levels of service calculated with state of the art software, and weighing these results with observations in the field. The study intersections include:

Intersection	Status
Zion Street at Ridge Road	Existing Intersection
Zion Street at Providence Mine Road	Existing Intersection
Zion Street at Doane Avenue	Existing Intersection
Zion Street at Brock Road	Existing Intersection

These intersections are all currently unsignalized, and have stop sign control on at least one approach.

Analysis Methodology

Synchro 5.0 was utilized to calculate level of service for each of the study intersections. The Synchro software is now capable of analyzing the intersection turning movements using a variety of different "views" of the traffic impacts, so that a better picture of what is taking place can be seen. Reference is made to Table 2A for a summary of the "delay" level of service criteria used in the analyses, and Table 2B for a summary of ICU level of service criteria. Levels of service were calculated using a delay criteria scale as follows:

Table 2A
Delay Level of Service Criteria

LOS	Unsignalized	Signalized
A	1-10 seconds	1-10 seconds
B	11-15 seconds	11-20 seconds
C	16-25 seconds	21-35 seconds
D	26-35 seconds	36-55 seconds
E	36-50 seconds	56-80 seconds
F	51+ seconds	81+ seconds

Source: PRISM Engineering, Synchro Pro, and HCM

Levels of service were also calculated using an ICU criteria scale as follows:

Table 2B
ICU Level of Service Criteria

LOS and ICU Range	A brief description of the conditions expected for each level of service follows:
LOS A **ICU <= 0.60**	*The intersection has no congestion. A cycle length of 80 seconds or less will move traffic efficiently. All traffic should be served on the first cycle. Traffic fluctuations, accidents, and lane closures can be handled with minimal congestion. This intersection can accommodate up to 40% more traffic on all movements.*
LOS B **0.60 < ICU** **ICU <= 0.70**	*The intersection has very little congestion. Almost all traffic will be served on the first cycle. A cycle length of 90 seconds or less will move traffic efficiently. Traffic fluctuations, accidents, and lane closures can be handled with minimal congestion. This intersection can accommodate up to 30% more traffic on all movements*
LOS C **0.70 < ICU** **ICU <= 0.80**	*The intersection has no major congestion. Most traffic should be served on the first cycle. A cycle length of 100 seconds or less will move traffic efficiently. Traffic fluctuations, accidents, and lane closures may cause some congestion. This intersection can accommodate up to 20% more traffic on all movements.*
LOS D **0.80 < ICU** **ICU <= 0.90**	*The intersection normally has no congestion. The majority of traffic should be served on the first cycle. A cycle length of 110 seconds or less will move traffic efficiently. Traffic fluctuations, accidents, and lane closures can cause significant congestion. Sub optimal signal timings cause congestion. This intersection can accommodate up to 10% more traffic on all movements.*
LOS E **0.90 < ICU** **ICU <= 1.00**	*The intersection is right on the verge of congested conditions. Many vehicles are not served on the first cycle. A cycle length of 120 seconds is required to move all traffic. Minor traffic fluctuations, accidents, and lane closures can cause significant congestion. Sub optimal signal timings can cause significant congestion. This intersection has less than 10% reserve capacity available.*
LOS F **1.00 < ICU** **ICU <= 1.10**	*The intersection is over capacity and likely experiences congestion periods of 15 to 60 minutes per day. Residual queues at the end of green are common. A cycle length over 120 seconds is required to move all traffic. Minor traffic fluctuations, accidents, and lane closures can cause increased congestion. Sub optimal signal timings can cause increased congestion.*

Source: PRISM Engineering, Synchro Pro, and HCM

Interpreting the "ICU" Level of Service

The ICU Level of Service (LOS) gives insight into how an intersection is functioning and how much extra capacity is available to handle traffic fluctuations and incidents. ICU is not a value that can be measured with a

stopwatch, but it does give a good reading on the conditions that can be expected at the intersection. This method of LOS rank is best suited for planning analyses, such as are used in traffic impact studies, and more especially for unsignalized intersections. It shows a more conservative LOS based on conditions that are more closely related to available capacity and its utilization, and not delay.

Interpreting the "Delay" Level of Service

The Intersection Delay field shows the average control delay for a signalized intersection and it is calculated by taking a volume weighted average of all the delays. The average intersection delay for unsignalized intersections based on an average of each movement's delays. This method of LOS rank is based on how well an intersection may operate given LOS enhancing mitigations through signal timing. For this reason, a "delay" LOS may be better than an "ICU" LOS due to signal timing benefits.

Tables 3 and 4 follow, and report the levels of service (ICU and Delay) for the two peak time periods (am: 7:30-8:30 and afternoon: 2:30-3:30), at each of the four study intersections. Table 3 reports the existing condition levels of service at the study intersections, and Table 4 reports the expected results with mitigations. The mitigations are two-fold, and are defined in detail below.

New Access to Providence Mine Road

One of the purposes of this report is the investigate the benefit (if any) that a new traffic route could have which connects the Seven Hills and/or Deer Creek schools to Providence Mine Road. A new connector could be provided to help relieve the congestion that now occurs along Doane Avenue, which serves as primary access for both schools to Zion Street. This new connector would pass through a portion of the Tectronix property and connect to Hoover Lane.

It is important to fully understand the traffic flows and conflicts that now exist at the Doane Avenue / Lindley Avenue intersection in order to ascertain what benefit or impacts could occur if a new connector is provided. Traffic from the Seven Hills School directly competes with the traffic from the Deer Creek School as they cross paths at this intersection. All school traffic using Lindley Road is as follows:

- Traffic northbound on Lindley Road just south of Doane Avenue is Deer Creek School traffic turning right onto Doane Avenue to get back to Zion Street. Currently, this direction does not compete with westbound Doane Avenue traffic entering the Deer Creek School, as the paths do not cross.
- Traffic on Lindley Road just north of Doane Avenue is a mixture of Seven Hills School traffic and Deer Creek School traffic, in both directions.

If a new connector is built to connect Hoover Lane over to Providence Mine Road through the Tectronix property school traffic patterns would shift. Traffic conditions at the Doane / Lindley intersection would most likely improve as the Seven Hills traffic is diverted away from this intersection.

Unfortunately, a side effect of this change will send more traffic to the eastbound approach of Providence Mine Road, which already experiences blocking during school peak hours due to the long lines of Zion Street traffic headed in the southbound direction. This additional school traffic will create significant impacts at a potential “choke point” along Zion Street very near to the already congested Ridge Road intersection. As traffic is further blocked at this intersection by concentrating even more traffic at it, the result will also spill over into the northbound left turn pocket of Zion Street at Providence Mine Road. If this left turn pocket is hindered it could have undesirable spill over effects to the Ridge Road intersection, causing some blocking at that location.

The Zion Street / Providence Mine Road intersection is already very close to the Zion Street / Ridge Road intersection, and it is best to minimize the impacts at Providence Mine. No connector road from Providence Mine Road to Lindley Avenue is recommended, as it will only further impact the Doane / Lindley intersection with more turning conflicts, or it will send more traffic to an intersection which already experiences blockage due to lines of traffic on Zion.

Increase Utilization of Buses

Bus traffic currently uses the Doane Avenue route as can be seen in Figure 5A. As can be seen from that photo, the buses generally travel together. They have a more difficult time gaining access to Zion Street from Doane Avenue because of the relative tight turning radius, and the lack of gaps in traffic. They are already a significant impedance to the efficient operations of Doane Avenue at Zion, and it is not recommended that more buses

impact this location. From a Zion Street traffic operations standpoint, the buses would better access Zion Street from the north at Brock, but this is not recommended due to potential neighborhood impacts, and the steep down-grade at the Brock Road approach to Zion Street.

If buses are directed to use a new connector to Providence Mine Road, this would create a worse situation to what is now taking place at the Doane Avenue intersection, due to the proximity to Ridge Road and lack of gaps in traffic along Zion Street southbound.

Adding more buses to the street system to reduce the number of vehicles will not have the desired effect to improve traffic flow. It will create more slow access to Zion Street, and cause larger turning movement impacts to the Doane / Lindley intersection, which also has a tight turning radius. It is not recommended to add more buses to the street system.

One Way Streets

A serious consideration was given to the one-way street concept, to better channelize traffic to and from the school campuses, to help reduce turning movement conflicts at various intersections. Any consideration to this idea has to take into account what it will do to Zion Street.

- If Doane Avenue is made into a one-way street inbound to the schools, then traffic would need to come out onto Brock Road. This is not desirable due to the impacts to Brock Road, as well as the steep down-grade approach of Brock to Zion, which makes safe access more difficult.
- If Doane Avenue is made into a one-way street outbound from the schools, then traffic would need to come in via Brock Road. This is actually a great improvement to Zion Street traffic flows and significantly reduces the conflicts of turning movements and traffic flows along Doane Avenue. Due to significant increases in traffic to Brock Road, it may not be desirable to the neighborhood residents to implement this change.

Other one-way street combinations will not help traffic operations along Zion Street, but would further exacerbate impacts from school traffic, including the potential Providence Mine Road connection which has been previously discussed.

Table 3

School Peak Hour Analysis Summary

Unmitigated Existing Condition

Study Intersection			AM Peak		AM Peak		AFT Peak		AFT Peak	
			delay secs	delay LOS	ICU ratio	ICU LOS	delay secs	delay LOS	ICU ratio	ICU LOS
1	4Way	Zion Street at Ridge Road	26	**D**	0.81	**D**	51	**F**	1.01	**F**
2	1Way	Zion Street at Providence Mine	21	**C**	0.67	**B**	36	**E**	0.72	**C**
3	1Way	Zion Street at Doane Avenue	26	**D**	0.87	**D**	19	**C**	1.16	**F**
4	1Way	Zion Street at Brock Road	22	**C**	0.78	**C**	19	**C**	0.81	**D**

Source: PRISM Engineering

Table 4

School Peak Hour Analysis Summary

Mitigated Condition

	Study Intersection	AM Peak delay secs	AM Peak delay LOS	AM Peak ICU ratio	AM Peak ICU LOS	AFT Peak delay secs	AFT Peak delay LOS	AFT Peak ICU ratio	AFT Peak ICU LOS
1	4Way Zion Street at Ridge Road	10	**A**	0.49	**A***	15	**B**	0.62	**B***
2	1Way Zion Street at Providence Mine	21	**C**	0.67	**B**	32	**D**	0.69	**B**
3	1Way Zion Street at Doane Avenue	13	**B**	0.68	**B**	25	**C**	0.77	**C**
4	1Way Zion Street at Brock Road	22	**C**	0.78	**C**	19	**C**	0.81	**D**

Source: PRISM Engineering

* from HCS Roundabout calculation

Note: Delay on 1Way control is calculated for side street

Traffic Demand Management (TDM) for schools

Shifting traffic times for the various schools has always been a great idea, and would significantly reduce traffic impacts, if it could be done. As it currently stands today, all schools impact the road system at nearly the same time periods, which creates a significant 20-30 minute peak that slows the system to a crawl. Changing school time periods will most likely be difficult due to the impact that it will have on family time schedules, and the parents who currently take their children to school. Currently, drivers of school children can drop off kids at a school safely, and get to another destination (such as work) on time. To shift a school schedule to a later hour may make the drop-off infeasible for many drivers. A survey conducted by the various school campuses should be conducted to ask the parents which time schedule works best for them, and depending on the results at each school, one or more campuses may be able to shift their school hours to a half hour later, etc. No recommendation can be properly made at the current time, due to a lack of data on driver preferences.

Mitigations

Mitigation 1: Improve Traffic Circulation in Immediate Vicinity of Schools

There are currently several permanent and temporary regulatory signs in use and installed by the City of Nevada City to help guide school related traffic to use certain routes / streets. Traffic signs shown in Figures 2, 5A, and 5B are installed to attempt to redirect school related traffic to use certain streets such as Doane Avenue, and prohibit the use of other streets such as Brock Road. Even with these signs installed, it is apparent that there are certain capacity constraints associated with Doane Avenue that motivate drivers to continue to use Brock Road due to excessive delays in the Doane Avenue route. The Doane Avenue route can be improved with the following changes to the system.

- Install a left turn pocket in the median of Zion Street to access Doane Avenue from the south, which will help to better facilitate inbound movement of school-related traffic, and eliminate delays to through traffic on northbound Zion Street.
- Remove parking on east side of Zion Street in the vicinity of Doane Avenue to accommodate the left turn pocket and thru lane northbound. No widening is needed on Zion Street, but only restriping and elimination of some parking as shown in Figure 6.

- Install a three-way stop sign control at the intersection of Zion Street and Doane Avenue to enable outbound left turns from Doane, which will likely lower traffic using Brock Road to accomplish this movement.

The proposed three way stop sign control at this intersection, and the proposed left turn pocket will help facilitate a left turn out from Doane Avenue, which is currently prohibited during school arrival and departure peaks with a portable No Left Turn sign as shown on Figure 2. If Doane Avenue is allowed to have a left turn outbound movement, the impact of traffic to the Zion Street / Ridge Road intersection will also be lessened, because at the present time, all traffic is forced to make a right turn and head towards that intersection. Reference is made to Figure 6 for an illustration of the existing configuration of Zion Street in the vicinity of Doane Avenue, and what is being proposed in this mitigation.

The existing condition is depicted on the left side of Figure 6 (not drawn to scale), and the proposed mitigation for the same area of Zion Street is shown on the right side of the figure (also not to scale). The legend of the figure shows parked cars in red, and all moving vehicles in the traveled way are depicted in white. Zion Street currently has parking on both sides of the street. Some of this parking would need to be eliminated on both sides to accommodate a median left turn lane, and to realign the centerline striping for southbound traffic at Doane Avenue as well as at Providence Mine Road.

Mitigation 2: Improve Traffic Flow and Capacity of Ridge / Zion Intersection

The intersection of Zion Street at Ridge Road is limited in capacity as currently configured (as a four way stop sign control at a skewed intersection, See Figure 7A). Traffic moves inefficiently through the intersection as drivers are constantly faced with moments of indecision, as it is difficult to know who's turn it is to enter the intersection. This is exacerbated by multi-lane approaches where up to nine drivers can face each other to "take a turn" at any one time. A traffic signal could help eliminate this decision problem, but a traffic signal is not conducive to the type of environment and setting desired for Nevada City. A better solution would be the installation of a modern roundabout at this location.

A roundabout would significantly improve traffic flows at this currently skewed intersection. Figure 7B shows the recommended roundabout design concept, which with a 150 foot diameter, will have enough capacity to handle area buildout traffic volumes at satisfactory levels of service. Better

yet, it will help efficiently move the peak school traffic volumes through the intersection, significantly reducing the long lines on Zion Street during school hours. The roundabout will help lessen the current impact of the skewed intersection approaches, and will help eliminate the current driver confusion and indecision which exists today. The installation of a circular roundabout (recommended) will require the acquisition of some additional right-of-way on the northwest and southeast quadrants of the intersection. Reference is made to Figure 7 for a CAD illustration (drawn to scale) of the proposed modern roundabout installation for this location.

The large 150 foot diameter circle can easily accommodate the largest of trucks and all buses that would enter the intersection. A dual lane approach is proposed for the Zion Street approach to facilitate the larger volumes of vehicles that will enter the roundabout from this approach. This dual lane approach will tend to favor traffic entering the circle from this direction (which will help alleviate the long lines of congestion that are now occurring on Zion Street for the southbound direction during peak hours). All approaches for the roundabout are yield on entry, meaning that all vehicles already in the circle have the right-of-way. The westbound approach of Ridge Road has a free-right turn lane to divert all Zion Street bound traffic away from interfering with roundabout traffic and capacity. The eastbound approach also has such a free-right lane.

Increasing the efficiency of the Zion / Ridge Road intersection with a modern roundabout design may have the undesired long-term side-effect of sending larger volumes of traffic in shorter amounts of time to the Ridge Road / Searls Avenue intersection, lengthening the queue of vehicles waiting to get through the same intersection. On Ridge Road during the school peak hour afternoon time period, a long line of vehicles often extends from Searls all the way back to Zion Street, creating a blockage for traffic trying to move forward from the southbound Zion Street left turn pocket, because the traffic on Ridge Road is not moving. Once the traffic on Ridge Road moves forward, then another vehicle can turn left from Zion Street. But as they wait, other vehicles from the westbound approach of Ridge Road move forward into that line, as well as northbound right turns from Nevada City Highway.

If a roundabout were installed under these conditions, the roundabout would break down in operations as traffic could not exit the roundabout. This would cause a traffic jam in all directions. The only way to absolutely prevent this from happening is to remove the Ridge Road stop sign at Searls

so that traffic will not back up from Searls to Zion Street. Ideally, a modern roundabout would also be installed on both sides of the SR 20/49 Gold Flat interchange bridge, so that all traffic could move efficiently, including traffic coming out from Searls. This is the focus of another study, however, and is only mentioned here as a concept.

The removal of the stop sign will enable Ridge Road traffic to move forward. The only potential side effect of removing this stop sign is to make it more difficult for Searls Road traffic to enter Ridge Road. This would make the "short cut" less desirable and cause some of these vehicles to enter the Zion Street / Ridge Road intersection. This would be alright with a modern roundabout installed, as traffic on Zion Street would clear quickly.

One other potential negative side-effect would be for slightly faster vehicle speeds on eastbound Ridge Road as they approach the interchange. This could make it more difficult for side street traffic to enter Ridge Road, whether from Searls, Lower Grass Valley Road, or from the freeway off-ramps. Since traffic patterns are not expected to change with the removal of the stop sign, there will be no negative impact to traffic operations or levels of service for the freeway off-ramps at this location. The same hourly volumes of traffic will be crossing paths during any time of the day.

Summary

- Install a modern roundabout at the intersection of Zion Street and Ridge Road according to that shown in Figure 7B.
- Remove the existing stop sign along Ridge Road eastbound approach to Searls Street intersection.
- Ideally, and when warranted by Caltrans, install a dual roundabout freeway interchange system (requires further study and definition), to further enhance capacity.

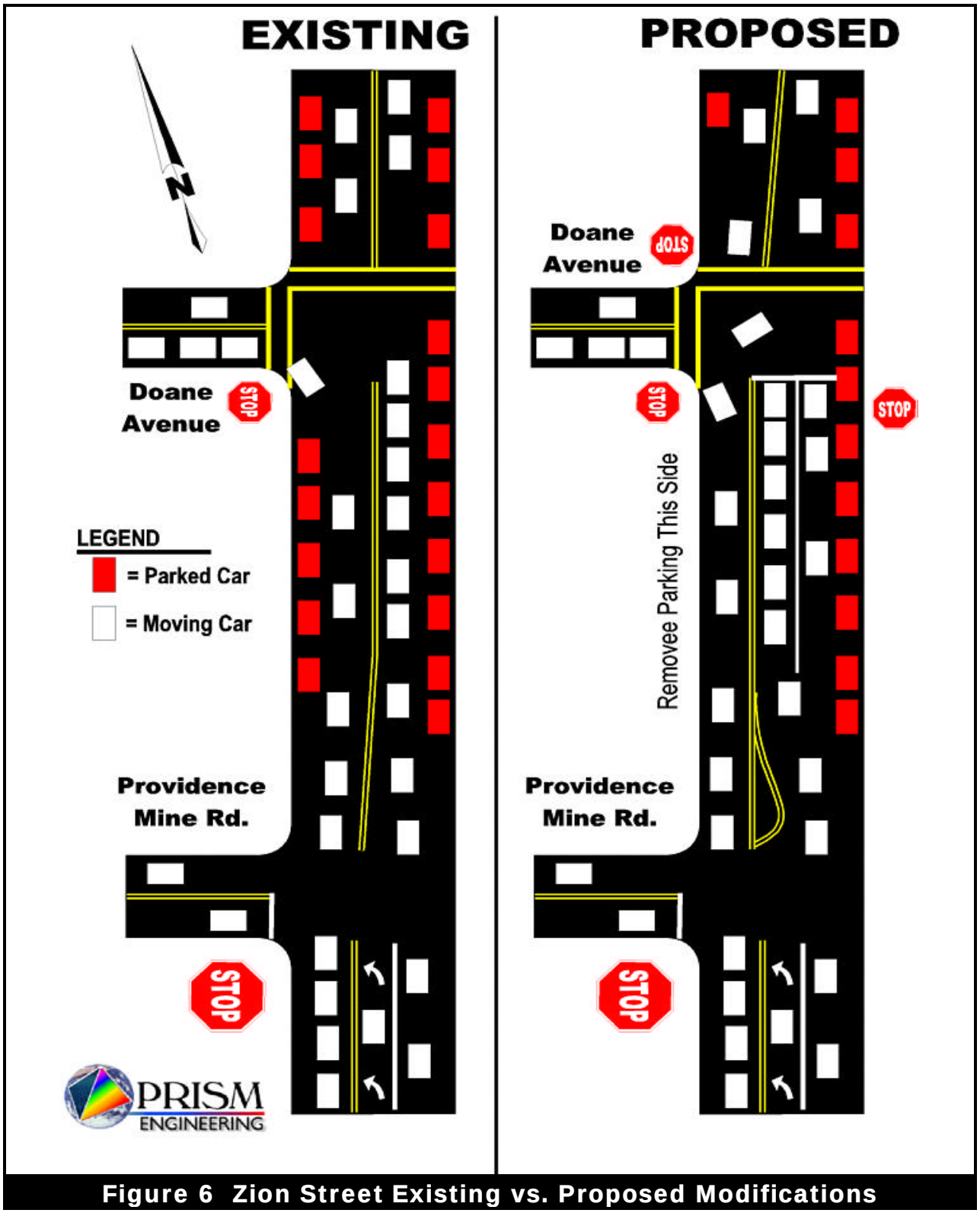

Figure 6 Zion Street Existing vs. Proposed Modifications

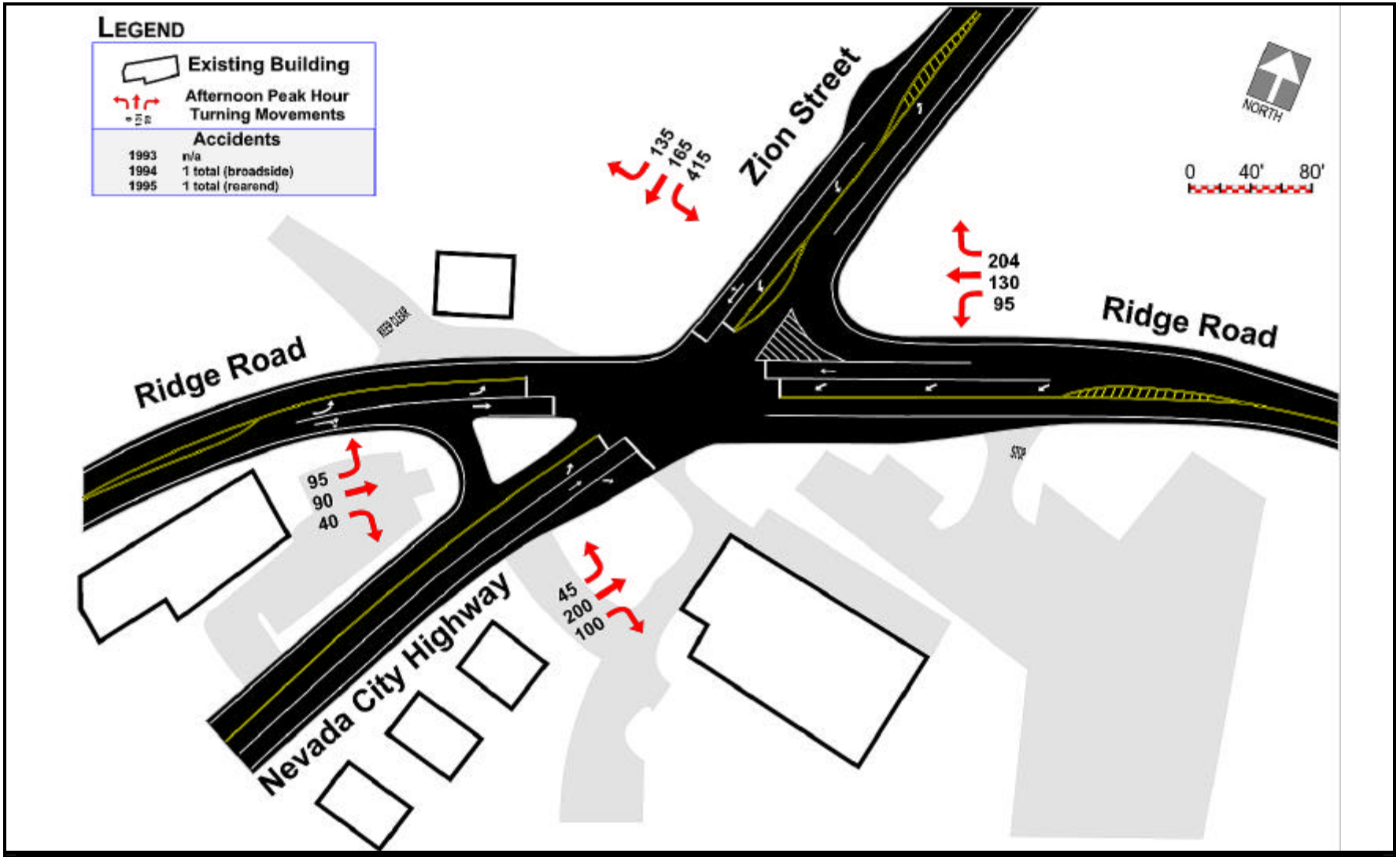

Figure 7A Ridge Road / Zion Street Existing Condition

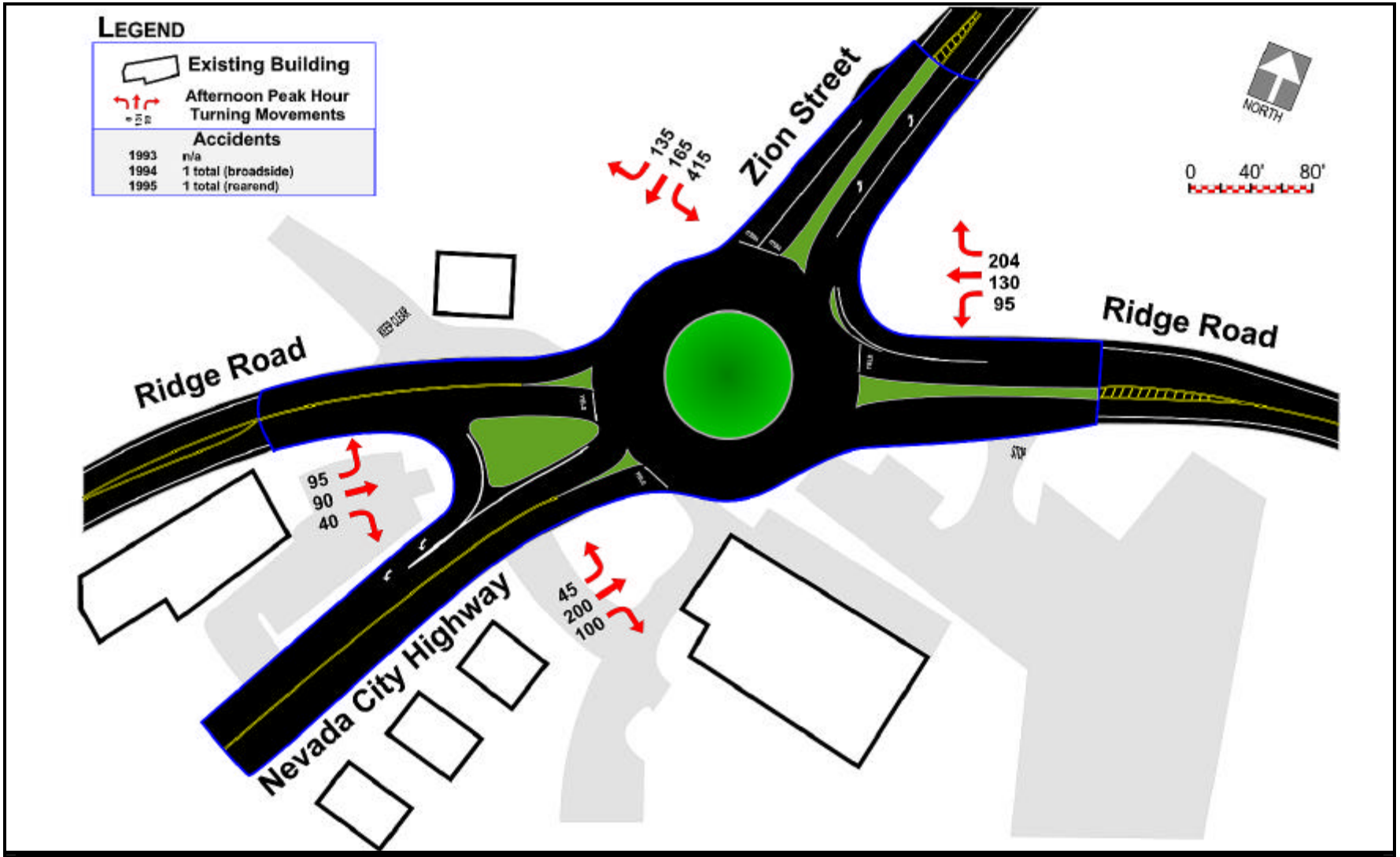

Figure 7B Ridge Road / Zion Street Proposed Modern Roundabout